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with the single genus *Myxine*. In the *Hyperoartia* or *Petromyzontidæ* he recognizes the genera *Petromyzon*, *Ichthyomyzon*, *Ammocætes*, *Entrophenus*, *Geotria*, *Exomegas* and *Caragola*. The form of the suproval laminæ is the principal character made use of, and *Caragola*, which has two such laminæ, is made the type of a sub-family.

#### PHYSIOLOGY.<sup>1</sup>

STUDY OF THE PHYSIOLOGY OF THE KIDNEY BY MEASUREMENTS OF ITS CHANGE OF VOLUME.—Dr. Roy has employed an ingenious instrument, the *oncometer*, devised by him on the principle of the *plethysmograph*, for the measurement of variations in the volume of the kidney. The apparatus consists essentially of a metallic box lined with a flexible membrane, in which the kidney of a living animal while in its normal situation can be laid and inclosed in an air-tight manner. The space between the kidney and the box is filled with warm oil which finds its exit by means of a tube terminating in an ingenious device furnished with a registering lever. With every increase in size of the kidney, a certain amount of oil must be forced out of the metal box and go to raise the lever of the registering apparatus; conversely, when the kidney diminishes in volume the lever falls, because the oil flows back into the kidney-box. The movements of the lever were recorded upon traveling paper. Living, narcotized cats, dogs and rabbits were experimented upon, and the operation, though apparently so severe, did not seem to interfere with the physiological action of the kidney, for the organ which was inclosed in the box secreted as abundantly as its fellow which remained in its natural surroundings.

The results of the experiments showed that the lever of the oncometer traced a curve which ran parallel to the general blood pressure curve as obtained from the femoral artery. Beside these slight changes of volume, due to heart beat and respiration, the two kidneys undergo slow, rhythmic but not simultaneous alternate increase and decrease of size. During the progress of an experiment a sudden shock to the animal or an insufficient supply of air would cause the general blood pressure to rise, but a diminution in the kidney-volume, showing a great constriction of the renal arteries and consequent scant amount of blood in the kidney. This vaso-motor constriction of the kidney arteries is due to a reflex action, for if the nerves entering the kidneys are severed in the hilus the volume of the kidney increases with the general rise of blood pressure which accompanies dyspnœa, as would follow on common hydraulic principles. Division of the splanchnic nerves, however, does not completely do away with the reflex. It is very difficult to manipulate the nerves entering the kidney, for some of the branches are intimately con-

<sup>1</sup> This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.

nected with the walls of the renal vessels. Stimulation of the proximal end of the divided sciatic nerve is accompanied by a rise of general blood pressure but by a fall in the volume of the kidney; which change, as in the previous case, is due to a vaso-motor reflex. The same results follow poisoning by strychnia. When the splanchnics are cut at the level of the diaphragm there is a slight momentary decrease in the volume of the kidney, and then a return to the normal. When the central or anterior end of a divided splanchnic is irritated, the volume of the kidney is diminished on both sides, showing a reflex vaso-motor constriction. Essentially the same effect follows when the peripheral ends of the divided splanchnics are stimulated. Vaso-motor fibers for both kidneys may run in the splanchnic of one side, but individuals differ in the extent to which this appears to occur. Vaso-motor fibers proceed to the kidney by paths other than the splanchnic nerves.

Complete or partial closure of one renal artery, during the course of an experiment, has no influence upon the blood current or the volume of the other kidney, nor does stopping the circulation in large extra-renal arteries, as those of the limbs, cause any change in the volume of the kidneys. The volume of the kidney was likewise quite uninfluenced when a dog under observation was surrounded alternately with ice-cold water and water heated to the body temperature.

THE ACTION OF ETHYL ALCOHOL UPON THE DOG'S HEART.—Professor Martin, with the assistance of a pupil, Mr. Stevens, has entered the debating ground of alcohol-physiology with some new and definite and therefore welcome statements of facts in regard to this subject. In the experiments of these gentlemen, the living but completely isolated dog's heart was supplied from a flask with an artificial current of warm blood, to which any chosen percentage of pure alcohol might be added. The authors sum up their results as follows: "When defibrinated blood containing  $\frac{1}{2}$  of one per cent by volume of ethyl alcohol is supplied to an isolated dog's heart which had been hitherto working with uniformity, the invariable result is a very rapid and marked diminution in the work done (indicated by the quantity of blood pumped out from the left ventricle) by the heart in a given time. When the blood contains only  $\frac{1}{4}$  of one per cent of alcohol, the result is, in most cases, the same, but sometimes is little or none. After the action of the alcohol has been fully manifested, the heart can, in many cases, be restored to its original working state if supplied with defibrinated blood containing no alcohol." It was noticed that the heart became more and more gorged, under the action of the alcohol, with increasing relaxation in diastole and decreasing extent of contraction in systole, until the resistance offered by the pericardium prevented farther increase of size in the heart cavities, and as the extent to which these were nar-

rowed in systole became gradually less, the amount of blood pumped out diminished proportionately. If the pericardium was now cut away the heart began immediately to pump out more blood, because its cavities expanded under the pressure upon them in diastole, while the extent to which they were constricted in systole remained the same. "The action of alcohol administered in the manner and doses above described is, without primarily altering the force of the heart beat, to alter its character, so that the ventricular cavity is not obliterated at the end of the systole, and the less so the longer the alcohol has been administered. At first this incomplete systole is compensated for by a more extensive diastole, so that the difference between the capacity of the ventricle in complete diastole and that in complete systole remains the same as when the organ was normally beating. Consequently the quantity of blood pumped out at each beat remains the same as before. If the heart be confined in the pericardium it soon, however, ceases to have room to swell during diastole to a size sufficient to compensate for its incomplete systole; and thenceforth, as the swelling increases the difference between diastolic and systolic capacity becomes less and less. As the necessary result, the quantity of blood pumped round by the organ is proportionately diminished. Removal of the pericardium prevents this result, at least for a considerable time." These experiments, and also careful observations on a human subject, failed to show any alteration of pulse rate due to alcohol.

RELATION OF ARTERIAL PRESSURE TO THE DURATION OF THE SYSTOLE AND DIASTOLE OF THE HEART-BEAT.—The study of the mammalian heart, as isolated by the Baltimore method, has been continued by Howell and Ely in determining whether the amount of arterial pressure, *i. e.*, the resistance which the ventricles must labor to overcome, has any relation to the duration of the various phases of the heart-beat, it having been previously determined that the number of complete beats in a given time was unaltered by very extensive variations of arterial pressure. In the experiments under consideration arterial pressure was varied by altering the height of the blood-outflow tube which communicated with the aorta. A slender rigid tube with a terminal and a side opening was passed through the superior vena cava and right auricle into the right ventricle. The two cavities of the heart were thus made continuous with that of the tube through the opening in the latter. The tube being filled with defibrinated blood was connected at its external extremity with an accurate registering instrument, by means of which changes of pressure within the heart cavities could be plainly recorded. Experiments performed in this manner show that variations of arterial pressure, at least within a range so extensive as that included between 50 and 160 mms. Hg., have no influence whatever upon the duration of either the systole or diastole of the heart-beat in the dog.